Regional Information Report 5J13-12

Report to the Alaska State Legislature on Status of Cook Inlet Coho and Sockeye Salmon Genetic Projects, 2013

by

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December 2013

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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REPORT TO THE ALASKA STATE LEGISLATURE ON STATUS OF COOK INLET COHO AND SOCKEYE SALMON GENETIC PROJECTS, 2013

by
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December 2013

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This document should be cited as:
DeCovich, N., A. Barclay, C. Habicht, M. Willette, L. Fair. E. Volk and W. Templin. 2013. Report to the Alaska State Legislature on status of Cook Inlet coho and sockeye salmon genetic projects, 2013. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-12, Anchorage.

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INTRODUCTION

The Alaska State Legislature has asked for a status report to Finance Committees detailing work in Cook Inlet on escapement monitoring, genetics baseline data, mixed stock sampling, smolt out migration, migratory studies and habitat improvements for Chinook, coho and sockeye salmon. This report summarizes status of activities associated with legislative increments directed at Cook Inlet coho and sockeye salmon genetics studies conducted by the Alaska Department of Fish and Game Gene Conservation Laboratory and Region II staff. For coho salmon, project updates for three investigative phases are provided. Phase 1 outlines results of studies using existing samples to determine if sufficient population genetic structure exists in Cook Inlet coho salmon to warrant construction of a full genetic baseline for genetic stock identification. Results demonstrated sufficient population structure for this effort. Phase II reports ongoing efforts to develop a genetic baseline for coho salmon in Cook Inlet using samples collected from spawning populations from 2012 to 2014, including weir sites throughout the district. Preliminary results indicate at least five genetic reporting groups are feasible, however, additional baseline collections will be necessary before genetic stock identification can be effectively applied to Cook Inlet fishery samples. Phase III involves application of genetic stock identification to coho harvested in test and commercial fisheries of Cook Inlet for the 2013–2015 seasons. To date, nearly 10,000 samples have been collected for future analysis from the Central District drift gill net fishery, the General and Eastern subdistrict set gill net fisheries, and the northern and southern offshore test fisheries. For sockeye salmon, we summarize status of a project to analyze DNA from archived scales as a means to retrospectively estimate stock composition in historic Cook Inlet harvests. This five-year project will provide means to reconstruct Susitna River escapement, and total runs for the major systems in Upper Cook Inlet.

Key words: Coho salmon, sockeye salmon, genetic stock identification, genetic baselines, mixed stock analysis.

COOK INLET COHO SALMON GENETIC STOCK IDENTIFICATION PROJECT

PHASE I: FEASIBILITY STUDY

In Phase I of the Cook Inlet Coho Salmon Genetic Stock Identification project, a skeleton baseline was developed and tested to ascertain whether sufficient population structure exists in Cook Inlet coho salmon to warrant the construction of a full genetic baseline for genetic stock identification (GSI). A full genetic baseline composed of genotypes from fish representing all spawning aggregates that might contribute to a fishery provides the foundation for GSI. The results of this phase show that GSI is likely to succeed, therefore a comprehensive baseline will be developed (Phase II), and GSI will be conducted on fishery samples collected during the 2013–2015 seasons (Phase III).

Two measures of population structure can be used to assess the potential for GSI: distribution of genetic variation among populations, and depth of this variation relative to the variation within populations. The distribution of genetic variation among populations can be visualized with genetic trees providing insights into what population groups (stocks) might be distinguishable for GSI. The depth of this variation relative to genetic variation within populations (F_{ST}) provides a means to ascertain how well the population groups might be distinguishable for GSI. Comparing F_{ST} values between coho salmon and other salmon species where GSI has been applied successfully within Cook Inlet provides context.

Tissues from 1,948 coho salmon collected over 22 locations within Cook Inlet (Table 1, Figure 1) were obtained from tissue archives at the Alaska Department of Fish and Game (ADF&G) and U.S. Fish and Wildlife Service and analyzed for 12 microsatellite and 107 single nucleotide polymorphism (SNP) markers. Genotyping was completed at the ADF&G Gene Conservation Laboratory and at the U.S. Fish and Wildlife Service Conservation Genetics Laboratory. Both marker types showed similar genetic structuring and levels of variation among collections. Because the full baseline and GSI analyses will use SNPs, results from the 107 SNPs screened are presented here.

A genetic tree using SNPs shows genetic similarities that generally follow geographic characteristics; however, some collections from different areas group together (Figure 2; the line distances between collections in the tree indicate genetic distances between collections). For example, southern Cook Inlet (Anchor, Tuxedni and Crescent rivers) and collections from the Kasilof and Kenai drainages (Nikolai River, Killey River, Skilak Lake and Snow River) form groups indicating their general similarity. However, some collections from geographically distant locations also group together (e.g., Larson Creek and Chickaloon River).

The pairwise F_{ST} values measured among the coho salmon collections using SNPs range from 0.00 to 0.17 and average 0.05. This level of variation among populations is similar to F_{ST} values using SNPs within Cook Inlet for sockeye salmon (range: 0.00–0.34, average: 0.12; Barclay and Habicht 2011) and Chinook salmon (range: 0.00–0.11, average: 0.04; Barclay et al. 2012). Both of these species currently have successful GSI programs within Cook Inlet.

The pattern of relationships among collections of coho salmon in Cook Inlet coupled with high F_{ST} values among those collections indicates that GSI will be possible for genetic studies in Cook Inlet. However, the incomplete correlation of genetic distance with geography in this initial study also indicates that the baseline will need to be comprehensive to provide an adequate understanding of population structure and accurate estimates for GSI.

A full report on Phase I is scheduled for completion at the end of March, 2014.

Table 1.–Source of Cook Inlet coho salmon tissue samples analyzed for Phase I of the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Area	Location	Year(s) Collected	Collection Size	Number Analyzed
Southwest Cook Inlet				
	Tuxedni River	2012	86	81
	Crescent Lake	1998	99	95
Westside Cook Inlet				
	Montana Bill Creek	2012	101	95
	Wilson Creek	2010	223	94
Susitna Drainage				
	Larson Creek	2011	84	84
Knik Arm				
	Fish Creek	2009	203	93
	Rabbit Slough	2011	95	95
	Matanuska River	2009	194	94
	Jim Creek	2009	68	68
Turnagain Arm				
	Sixmile Creek	2009	46	45
	Chester Creek	2011	54	53
	Ship Creek	2012	400	93
	Campbell Creek	2009	125	95
	Rabbit Creek	2011	54	53
	Resurrection Creek	2010	96	93
	Chickaloon River	2010	118	100
Northwest Kenai Peninsula				
	Sucker Creek	1997	94	91
Kenai Drainage				
	Snow River	1998, 2002	123	95
	Skilak Lake	1999	160	156
	Killey River	2000, 2002	117	92
Kasilof River Drainage				
	Nikolai Creek	2009	92	88
Southeast Cook Inlet				
	Anchor River	2006, 2009	204	95
		Total	2,836	1,948

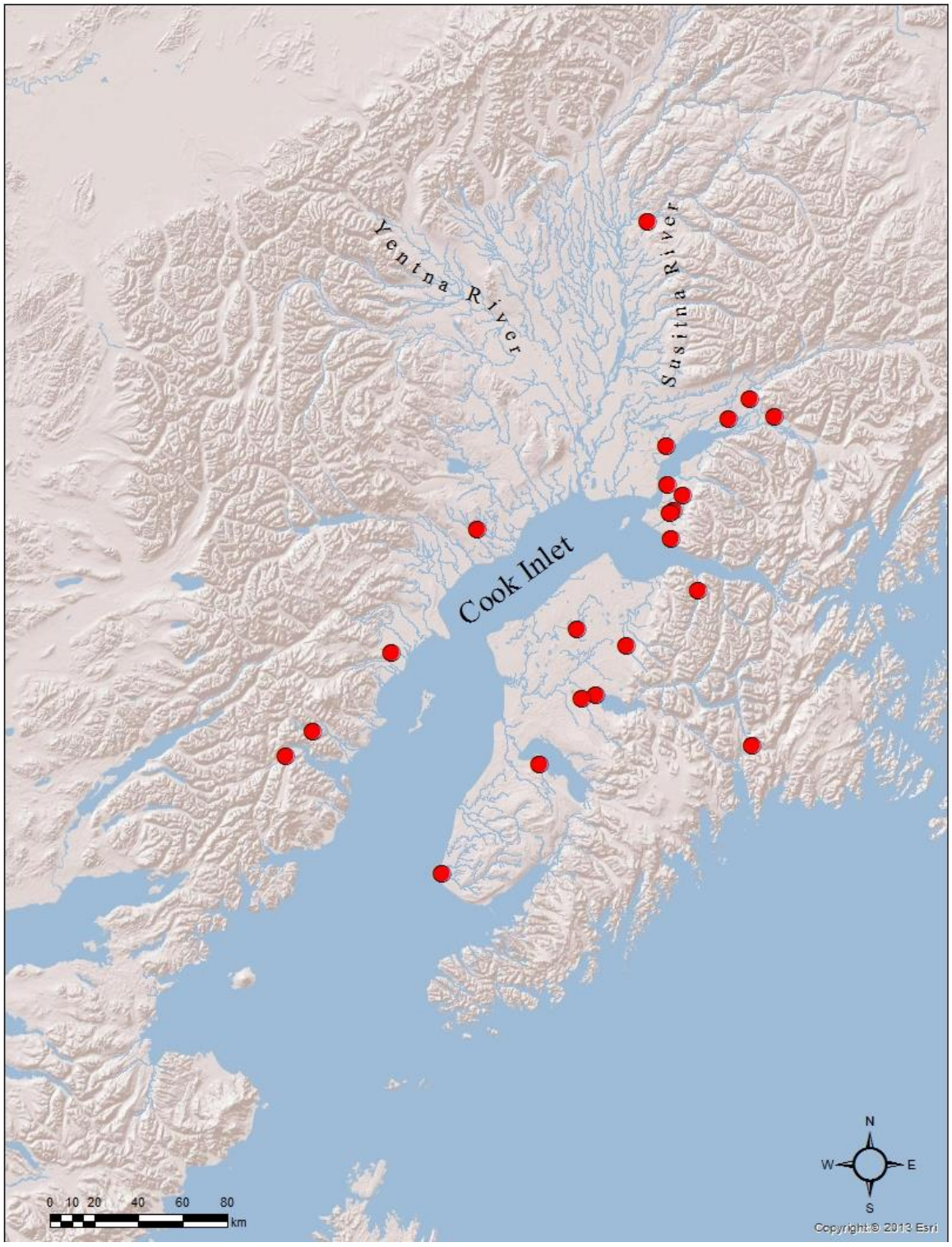

Figure 1.–Map showing locations of coho salmon collections analyzed for Phase I of the Cook Inlet Coho Salmon Genetic Stock Identification Project.

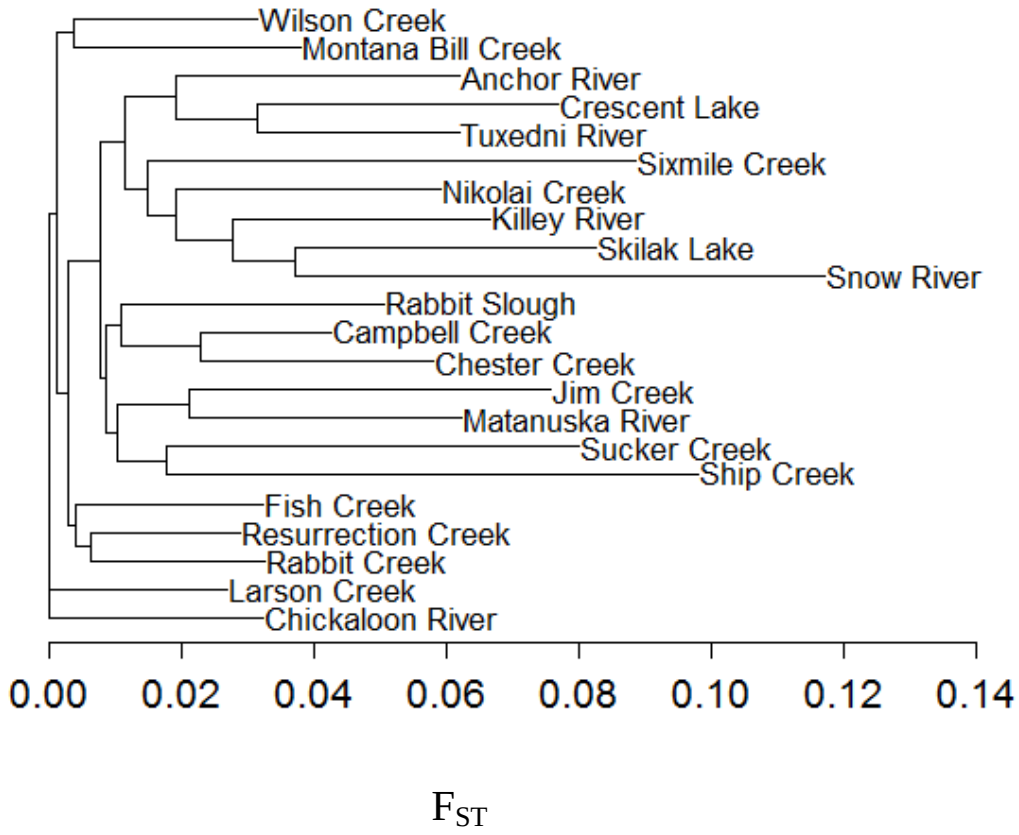

Figure 2.–Cavalli-Sforza and Edwards (1967) genetic tree of F_{ST} values among coho salmon collections based on 107 SNPs analyzed for Phase I of the Cook Inlet Coho Salmon Genetic Stock Identification Project.

PHASE II: BASELINE DEVELOPMENT

In Phase II of the Cook Inlet Coho Salmon Genetic Stock Identification the genetic baseline is being developed for use in the analysis of fishery samples collected during the 2013–2015 seasons (Phase III). A baseline composed of genotypes from fish representing all spawning aggregates that might contribute to a fishery provides the foundation for genetic stock identification (GSI). Phase I demonstrated that sufficient population structure existed in Cook Inlet coho salmon to warrant construction of a genetic baseline for GSI.

To date, tissues were collected from 2,386 coho salmon using funds from this project. Of these, 1,778 were collected in the summers of 2012 and 2013 by crews from the ADF&G Gene Conservation Laboratory and an additional 608 fish were sampled at weirs operated by ADF&G Sport Fish Division (Table 2, Figure 3). See Appendix A for a detailed list of all collection locations and sample sizes per collection available in ADF&G and U.S. Fish and Wildlife Service archives. In a preliminary part of the Phase II analysis, a subset of these collections representing 46 spawning aggregates were genotyped and analyzed using a subset of the most informative genetic markers evaluated during Phase I (Table 3, Figure 4). The population structure revealed by this analysis shows promise for apportioning fishery mixture samples into at least five reporting groups (Figure 5). This analysis also demonstrated that additional baseline collections will be necessary before GSI can be applied to Cook Inlet fishery samples.

Table 2.–Source of Cook Inlet coho salmon tissue samples currently available for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Source	Number	Percentage of baseline
ADF&G archive	2,333	31%
USFWS archive	2,198	29%
This project		
Gene Conservation Laboratory	1,778	23%
Sport Fish weirs	608	8%
Alaska Energy Authority	499	7%
Cook Inlet Aquaculture Association	100	1%
Total	7,516	100%

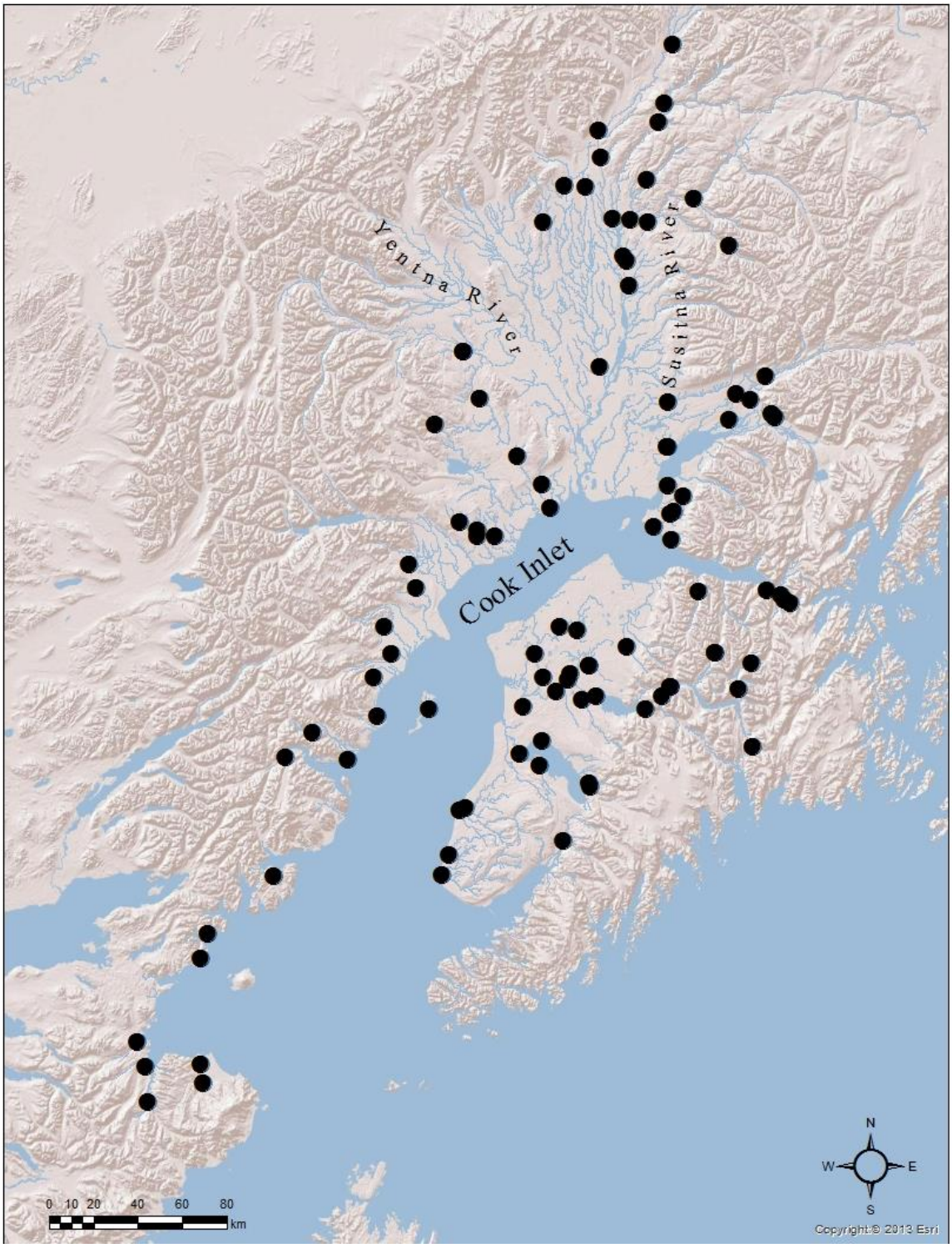

Figure 3.–Map showing locations of coho salmon tissue collections currently available for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Table 3.–Collection location of coho salmon samples analyzed to date for 48 single nucleotide polymorphism markers for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Area	Location	Year(s) Collected	Number Analyzed	Latitude	Longitude
Southwest Cook Inlet					
	Douglas River - Clearwater	2013	93	58.9507	–153.7603
	Douglas Reef River	2013	95	59.0280	–153.7829
	Kamishak River	2013	91	58.8772	–154.1951
	Little Kamishak River	2013	95	59.0185	–154.2192
	Tuxedni River	2012	81	60.2597	–153.0815
	Crescent Lake - Late	1998	93	60.3569	–152.8631
	Crescent River	2013	93	60.3603	–152.8009
Westside Cook Inlet					
	Little Jack	2013	95	60.5755	–152.3477
	Montana Bill Creek	2012	95	60.6675	–152.1969
	Kustatan River	2013	95	60.9267	–151.9739
	Wilson Creek	2010	93	61.1519	–151.4490
	Theodore River weir	2013	60	61.2302	–150.8341
	Lewis River weir	2013	57	61.3268	–150.8929
Susitna Drainage					
	Indian River	2013	94	62.8265	–149.6483
	Whiskers Creek	2013	78	62.3754	–150.1695
	Troublesome Creek	2013	72	62.6267	–150.2374
	Sheep River	2013	95	62.2380	–149.1686
	Larson Lake - outlet stream	2011	84	62.3570	–149.8614
	Chunilna Creek - Clear Creek	2013	65	62.5267	–149.8447
	Question Creek	2013	76	62.2221	–150.0885
	Montana Creek weir	2013	92	62.1051	–150.0569
Yentna Drainage					
	Canyon Creek	2013	55	61.8727	–151.5116
	Talachulitna River	2013	72	61.6815	–151.3862

-continued-

Table 3.–Page 2 of 2.

Area	Location	Year(s) Collected	Number Analyzed	Latitude	Longitude
Knik Arm					
	Little Susitna River	2013	94	61.6250	–149.7858
	Fish Creek	2009	94	61.4486	–149.8211
	Rabbit Slough	2011	95	61.5414	–149.2756
	Eska Creek	2013	59	61.7019	–148.9431
	Matanuska River mainstem	2009	94	61.6125	–149.0880
	Jim Creek	2009	68	61.5368	–148.8840
Turnagain Arm					
	Chester Creek	2011	53	61.1861	–149.7972
	Ship Creek	2012	93	61.2455	–149.7100
	Campbell Creek	2009	94	61.1787	–149.8307
	Rabbit Creek	2010	53	61.0761	–149.8291
	Resurrection Creek	2010	94	60.8581	–149.6340
	Mystery Creek - Chickaloon	2010	100	60.6572	–150.2525
Northwest Kenai Peninsula					
	Sucker Creek	1997	91	60.7322	–150.6573
Kenai Drainage					
	Snow River - South Fork	1998, 2002	95	60.2238	–149.2792
	Russian River	2013	91	60.4474	–149.9854
	Skilak Lake	1999	78	60.4657	–150.5309
	Killey River	2000, 2002	92	60.4522	–150.6400
Kasilof Drainage					
	Nikolai Creek	2009	86	60.1936	–151.0129
Southeast Cook Inlet					
	Ninilchik River	2013	93	60.0383	–151.6310
	Deep Creek	2013	95	60.0294	–151.6792
	Anchor River	2006, 2009	94	59.7701	–151.8433
	Stariski Creek	2013	51	59.8499	–151.7782
Total			3776		

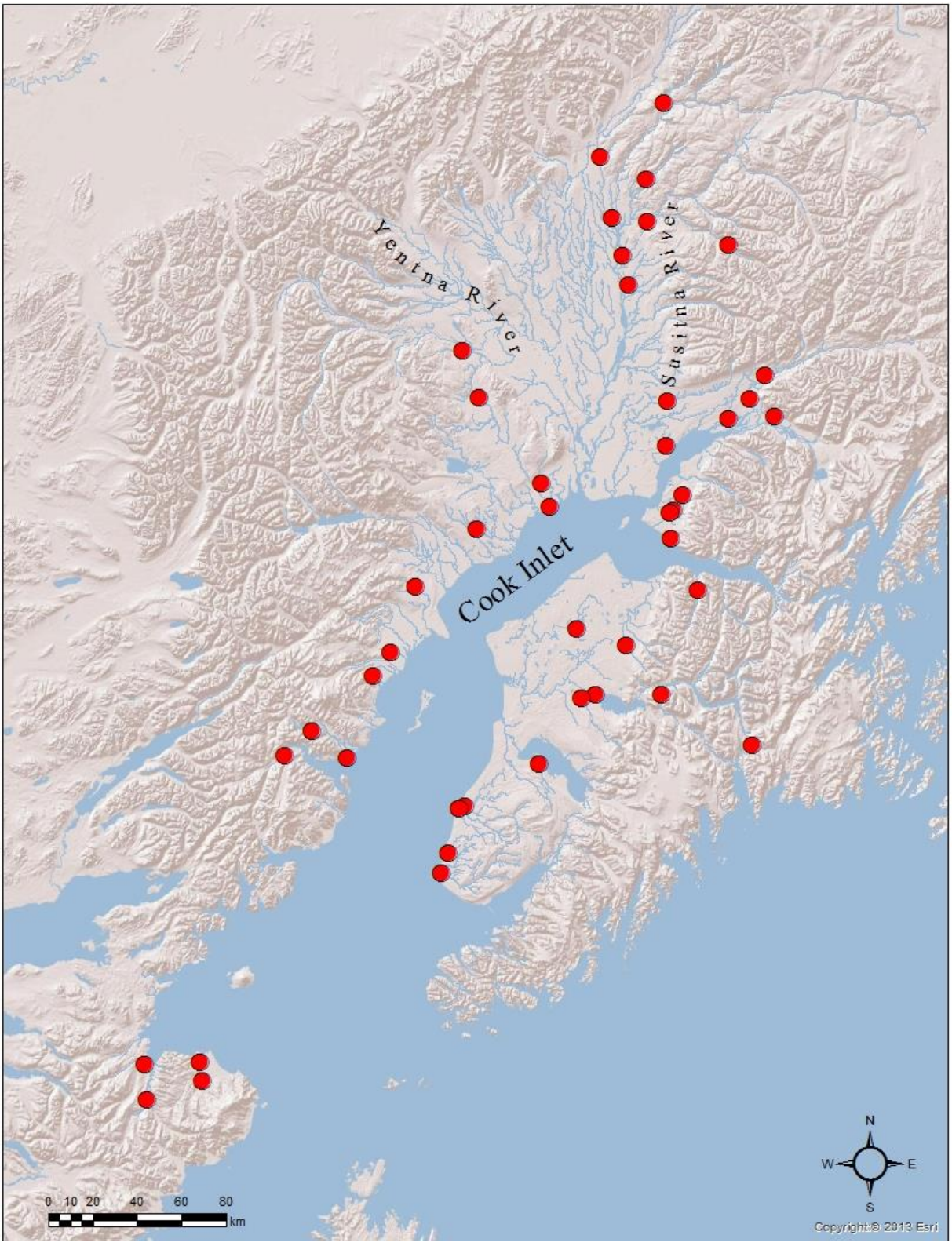

Figure 4.–Map showing location of coho salmon samples analyzed to date for 48 single nucleotide polymorphism markers for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

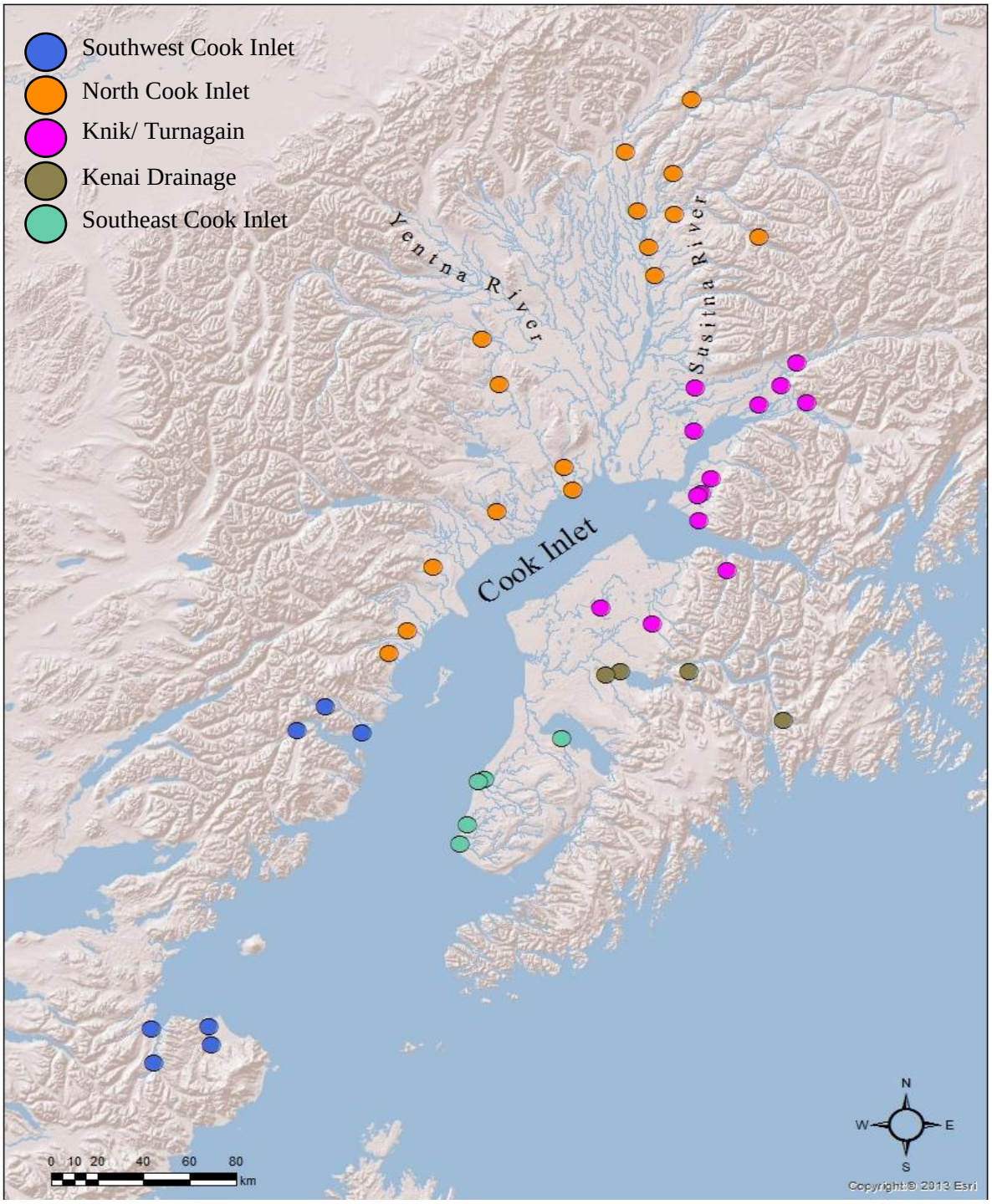

Figure 5.–Map representing five reporting groups identified during preliminary analysis in Phase II of the Cook Inlet Coho Salmon Genetic Stock Identification Project. Finer scale groups may be possible when additional baseline collections from the summer of 2014 are included.

In the final year of this project (2014), additional baseline samples will be collected. Priorities will be to target 1) spawning aggregates represented by fewer than 50 fish in the current baseline, and 2) unsampled locations that represent significant spawning aggregates. Additional genetic markers will also be assayed across this larger baseline and statistical analyses will be conducted to further assess reporting groups and GSI performance.

PHASE III: FISHERY ANALYSIS

Phase III of the Cook Inlet Coho Salmon Genetic Stock Identification Project involves application of genetic stock identification (GSI) to samples of coho salmon harvested in the test and commercial fisheries of Cook Inlet in the 2013–2015 seasons. Phase I demonstrated that sufficient population structure existed in Cook Inlet coho salmon to warrant the construction of a genetic baseline for GSI. Phase II is currently developing and testing the genetic baseline for GSI.

In 2013, tissue samples were collected from coho salmon captured in the commercial fishery and offshore test fisheries in Cook Inlet. A total of 9,912 fish were sampled. The harvest samples were collected from the Central District drift gillnet fishery (3,379 fish), the General Subdistrict set gillnet fishery (3,989 fish), and the Eastern Subdistrict set gillnet fishery (1,257 fish). The offshore test fishery catch samples were collected from the Northern (499 fish) and Southern (788 fish) fishery stations (Table 4, Figure 6).

In the spring of 2014, DNA extraction and genotyping will begin on approximately 5,287 of the 9,912 fish sampled in 2013 using the set of genetic markers selected during Phase II of this project. Approximately 2,400 fish will be genotyped from the Central District drift gillnet fishery. Approximately 800 fish will be genotyped from each of the Eastern Subdistrict set gillnet and General Subdistrict set gillnet fisheries (Table 4). Fish sampled from these harvests will be sub-sampled in proportion to harvest numbers so final numbers of analyzed fish will depend on the time by area strata for each fishery. All of the fish collected in the offshore test fisheries in 2013 are anticipated to be genotyped.

This phase will continue through the collection of fishery samples in 2015. GSI will be possible for 2013 and 2014 samples once Phase II is complete in winter of 2014/2015. GSI of 2015 collections will be completed in winter of 2015/2016 and the final report will be available in spring of 2016.

Table 4.–Number of coho salmon collected by fishery in 2013 and the number anticipated to be genotyped for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Fishery	Number collected	Number anticipated to genotype
Commercial harvest		
Central District drift gillnet	3,379	2,400
General Subdistrict set gillnet	3,989	800
Eastern Subdistrict set gillnet	1,257	800
Total commercial harvest	8,625	4,000
Offshore test fishery catches		
Northern	499	499
Southern	788	788
Total offshore test fishery catches	1,287	1,287
Grand total	9,912	5,287

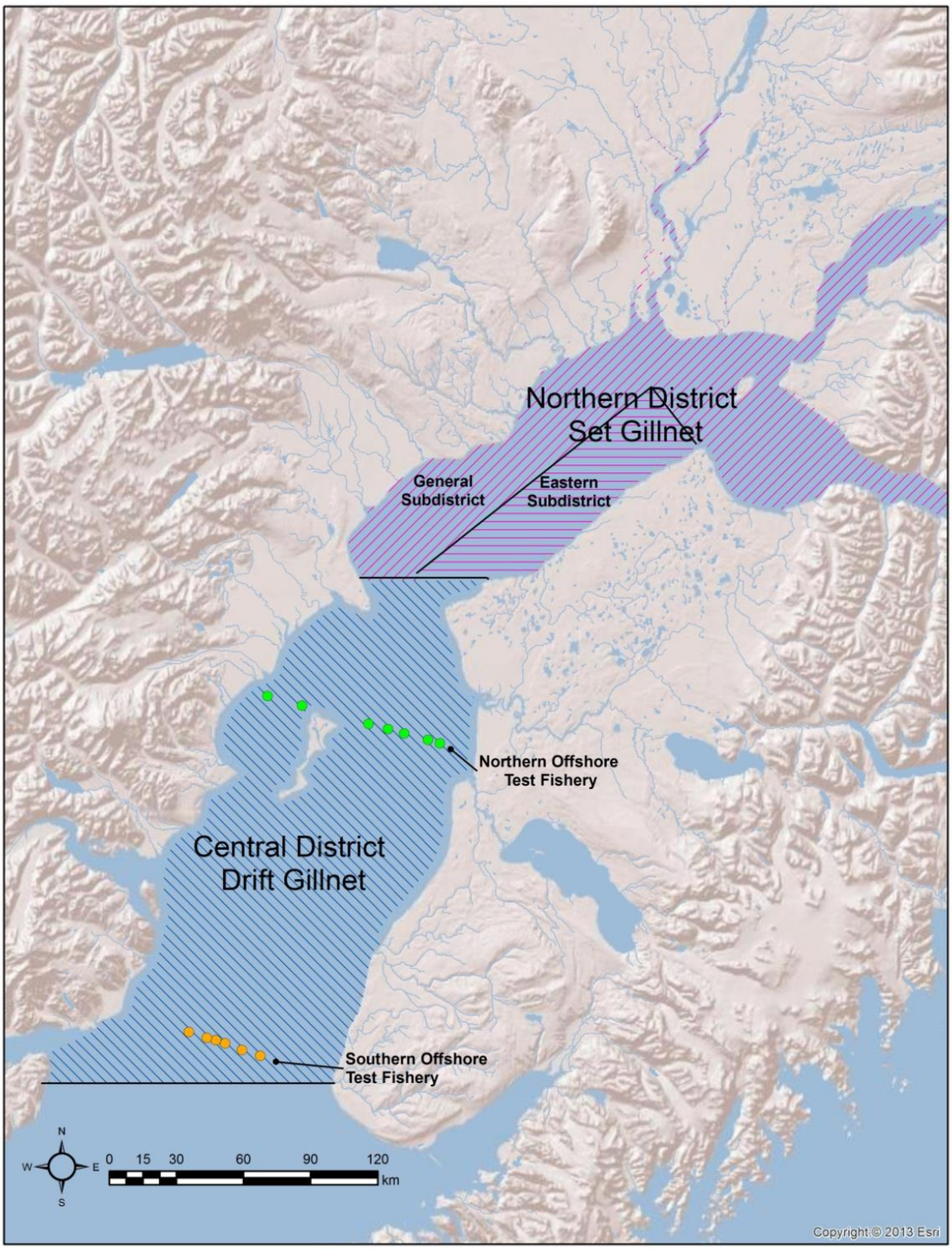

Figure 6.–Map of Cook Inlet showing locations of commercial and test fisheries sampled for coho salmon in 2013 for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

COOK INLET SOCKEYE SALMON RETROSPECTIVE ANALYSIS, 2013

This is the first year of a five-year retrospective analysis project by ADF&G that will use recently developed genetic technologies to extract DNA from archived scales sampled from sockeye salmon captured in selected Upper Cook Inlet commercial fisheries from 1986 to 2005. The DNA will then be used to estimate stock composition of historic harvests with genetic stock identification (GSI) in the same way that has been used annually with contemporary harvests since 2006. This information can be used to achieve two objectives:

1. Reconstruct Susitna River escapement. Sonar estimates of sockeye salmon escapement in the Yentna River go back into the 1980s but appear to be a poor indicator of escapement (Fair et al. 2009). Sporadic weir counts also exist for select systems within the Susitna drainage beginning in the 1970s, three of which now have sustainable escapement goals. However, it is only since 2006 that ADF&G has estimates of total drainage-wide escapement. Susitna River escapements from 1986 to 2005 will be reconstructed by first estimating the proportion of Susitna River-bound fish from historical catches in the Central District drift gillnet, Eastside set gillnet, and Northern District set gillnet fisheries since these harvest areas intercept the vast majority (98%) of Susitna River sockeye salmon harvested in Upper Cook Inlet (Table 5; Barclay et al. 2010). DNA will be extracted from historical scales collected from harvests in these three areas using standard methods similar to a recent Bristol Bay study (Smith 2010). Escapement to the Susitna River drainage will then be estimated using the annual proportional harvest in the historic commercial fisheries with the same method used since 2006.

2. Reconstruct Upper cook Inlet total runs for the major systems. The harvest of sockeye salmon in Cook Inlet can be separated into four large-scale stocks: Kenai, Kasilof, and Susitna River, and "Other". This objective will use a modified version of the Bristol Bay run reconstruction model (Cunningham et al. 2012) that accounts for the unique characteristics of Upper Cook Inlet fisheries and escapements and will tie in the critical components from Objective 1.

Initial planning for this project has been based on target sample sizes of 400 fish per fishery stratum for each year from 1986 to 2005 (Table 6). This is a good starting point, but necessary sample sizes could change depending on the success rate of extracting usable DNA from scales. The highest priority sample group is the Central District drift gillnet fishery because most Susitna-bound fish are harvested in this fishery stratum (Table 5). For this reason, samples from the Central District drift gillnet fishery for all years will be analyzed prior to the Eastside set gillnet and Northern District set gillnet fishery samples. Using this method, sample sizes from the Eastside set gillnet or Northern District set gillnet harvests can be reduced if funding is insufficient to complete the project.

During the winter of 2013/2014, a set of 6,000 individual scale samples will be identified from the archived scale cards collected from the Central District drift gillnet fishery harvests from 1986 to 2000. During the spring of 2014, DNA extraction and genotyping will begin on approximately 6,000 of the approximately 23,600 fish necessary to complete this project. We expect to continue at this rate and complete the project in five years, 2018.

Table 5.–Proportion of total Susitna River sockeye salmon harvest in Upper Cook Inlet gillnet fishery strata, 2006–2012.

Fishery stratum	Mean	Min	Max
Central District drift	0.706	0.459	0.839
Eastside (Upper Subdistrict) set			
Kasilof Section set	0.051	0.001	0.146
Kenai/East Forelands sections set set	0.056	0.009	0.140
Kalgin Island Subdistrict set	0.015	0.002	0.075
Western Subdistrict set	0.001	0.000	0.003
Northern District set	0.042	0.005	0.089

Table 6.–Initial sample sizes to estimate stock composition of sockeye salmon from each gillnet fishery stratum by year in Upper Cook Inlet. Shaded cells indicate the samples to be analyzed during spring 2014.

Year	Central District drift	Eastside set	Northern District set	Total
1986	400	400	400	1,200
1987	400	400	400	1,200
1988	400	400	400	1,200
1989	400	400	400	1,200
1990	400	400	400	1,200
1991	400	400	400	1,200
1992	400	400	400	1,200
1993	400	400	400	1,200
1994	400	400	400	1,200
1995	400	400	400	1,200
1996	400	400	400	1,200
1997	400	400	400	1,200
1998	400	400	400	1,200
1999	400	400	400	1,200
2000	400	400	400	1,200
2001	400	400	400	1,200
2002	400	400	400	1,200
2003	400	400	400	1,200
2004	400	400	400	1,200
2005	400		400	800
Total	8,000	7,600	8,000	23,600

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APPENDIX

Appendix A.–Genetic tissue collections from Cook Inlet coho salmon currently in ADF&G archives available for the Cook Inlet Coho Salmon Genetic Stock Identification Project.

Area/Drainage	Location	Year Collected	N	Source[a]
West Side				
	Douglas River - Clearwater	2013	106	GCL Collections
	Douglas Reef River	2013	113	GCL Collections
	Kamishak River	2013	110	GCL Collections
	Little Kamishak River	2013	96	GCL Collections
	McNeil River	2013	41	GCL Collections
	Sunday Creek	2012	7	GCL Collections
	Brown's Peak Creek	2013	9	GCL Collections
	Fitz Creek	2013	3	GCL Collections
	Tuxedni River	2012	86	ADF&G Archives
	Crescent Lake - Late	1998	99	USFWS Archives
	Crescent River	2012	1	GCL Collections
	Harriet Creek	2012	1	GCL Collections
	Packers Creek	2013	4	GCL Collections
	Little Jack	2013	104	GCL Collections
	Montana Bill Creek	2012	101	GCL Collections
	Big River	2009	19	ADF&G Archives
	Kustatan River	2013	119	GCL Collections
	Farro Lake Outlet Creek	2013	17	GCL Collections
	Chuitna River	1992	54	USFWS Archives
	Wilson Creek	2010	223	ADF&G Archives
	Middle Creek	2008	40	ADF&G Archives
	Lone Creek	2008	70	ADF&G Archives
	Coal Creek	2013	41	GCL Collections
	Theodore River	2012	19	GCL Collections
	Theodore River weir	2013	60	ADF&G Sport Fish
	Lewis River weir	2013	57	ADF&G Sport Fish
Susitna Drainage				
	Indian River	2013	104	AEA
	Susitna River - Slough 11	2013	1	AEA
	Whiskers Creek	2013	79	AEA
	Honolulu Creek	2013	4	AEA
	Spink Creek	2008	38	ADF&G Archives
	Troublesome Creek	2013	92	AEA
	Bunco Creek	2013	9	AEA
	Swan Lake	2009	20	ADF&G Archives
	Iron Creek	2013	28	AEA
	Sheep River	2013	115	AEA
	Larson Creek	2011	84	ADF&G Archives
	Chunilna Creek - Clear Creek	2013	66	AEA
	Fish Creek	2013	1	AEA
	Answer Creek	2013	7	GCL Collections
	Question Creek	2013	77	GCL Collections
	Montana Creek weir	2013	200	ADF&G Sport Fish
	Deshka River	2013	100	ADF&G Sport Fish

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Area/Drainage	Location	Year Collected	N	Source[a]
Yentna Drainage				
	Martin Creek	2013	35	GCL Collections
	Canyon Creek	2013	55	GCL Collections
	Canyon Creek - mouth	2008	20	ADF&G Archives
	Talachulitna River	2013	74	GCL Collections
Knik Arm				
	Little Susitna River	2013	97	ADF&G Sport Fish
	Fish Creek	2009	203	ADF&G Archives
	Fish Creek weir	2013	94	ADF&G Sport Fish
	Wasilla Creek	2013	9	GCL Collections
	Rabbit Slough	2011	95	ADF&G Archives
	Eska Creek	2013	61	GCL Collections
	Matanuska River mainstem	2008	135	USFWS Archives
	Matanuska River mainstem	2009	194	USFWS Archives
	Jim Lake	2011	7	ADF&G Archives
	Jim Creek	2009	68	ADF&G Archives
	Sixmile Creek	2009	46	ADF&G Archives
	Chester Creek	2011	54	ADF&G Archives
	Ship Creek	1991	11	ADF&G Archives
	Ship Creek	2012	400	GCL Collections
Turnagain Arm				
	Campbell Creek - near weir site	1995	5	ADF&G Archives
	Campbell Creek	2009	125	ADF&G Archives
	Campbell Creek	2010	9	ADF&G Archives
	Rabbit Creek	2011	54	ADF&G Archives
	Williwaw Creek	2013	22	GCL Collections
	Portage Creek - #2	2013	5	GCL Collections
	Explorer Pond	2013	94	GCL Collections
	Ingram Creek	2013	7	GCL Collections
	Resurrection Creek	2010	96	ADF&G Archives
	Mystery Creek	2010	22	ADF&G Archives
	Chickaloon River	2010	82	ADF&G Archives
Northwest Kenai Peninsula				
	Sucker Creek	1997	94	USFWS Archives
	Gruska Creek	2013	53	GCL Collections
Kenai Drainage				
	Grant Creek weir	2013	100	CIAA
	Snow River - South Fork	1998	73	USFWS Archives
	Snow River - South Fork	2002	50	USFWS Archives
	Trail Creek	2006	134	USFWS Archives
	Summit Creek/Quartz Creek	1998	75	USFWS Archives
	Summit Creek	2002	50	USFWS Archives
	Moose Creek - Kenai River	1993	150	ADF&G Archives
	Below Kenai Lake (mainstem)	1999	22	USFWS Archives
	Below Kenai Lake (mainstem)	1999	34	USFWS Archives
	Below Kenai Lake (mainstem)	2002	57	USFWS Archives

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Area/Drainage	Location	Year Collected	N	Source[a]
	Russian River	2002	31	USFWS Archives
	Russian River	2013	101	GCL Collections
	Skilak Lake - Upper	1999	60	USFWS Archives
	Skilak River	2003	100	USFWS Archives
	Skilak Lake - Lower	1999	20	USFWS Archives
	Below Skilak Lake (mainstem)	1999	20	USFWS Archives
	Below Skilak Lake (mainstem)	1999	60	USFWS Archives
	Killey River	2000	68	USFWS Archives
	Killey River	2002	49	USFWS Archives
	Moose River - East Fork	2002	100	USFWS Archives
	Moose River - East Fork	2000	11	USFWS Archives
	Moose River weir	1998	35	USFWS Archives
	Funny River	2006	150	USFWS Archives
	Soldotna Creek	2013	8	GCL Collections
	Slikok Creek	2008	67	USFWS Archives
	Beaver Creek	2013	12	GCL Collections
Kasilof Drainage				
	Glacier Creek	2009	68	USFWS Archives
	Indian Creek	2009	55	USFWS Archives
	Shantatalik Creek	2009	41	USFWS Archives
	Nikolai Creek	2009	92	USFWS Archives
	Kasilof River mainstem	2009	100	USFWS Archives
Southeast Cook Inlet				
	Ninilchik River	2013	108	GCL Collections
	Deep Creek	2013	101	GCL Collections
	Anchor River weir	2006	164	ADF&G Archives
	Anchor River weir	2009	40	ADF&G Archives
	Stariski Creek	2013	59	GCL Collections
	Fox River	2013	100	GCL Collections
Total			7,516	

[a] Sources of tissues or funding include collections by the ADF&G Gene Conservation Laboratory (GCL) under this project, ADF&G archives, U.S. Fish and Wildlife Service (USFWS) archives, ADF&G Sport Fish Weirs (Sport Fish), Alaska Energy Authority (AEA), and Cook Inlet Aquaculture Association (CIAA).